Remarks/Arguments:

Applicants thank Examiner Luhrs for his careful examination of this application and clear and detailed explanation of the issues and the claim rejections. In response, applicants amend the application as follows:

1. Applicants are preparing a petition to be submitted to correct the inventorship.
2. Applicants amend the title to be more descriptive of the invention.
3. Applicants amend claim 1 to describe the invention more clearly and overcome the informality noted in §7 of the Office action.
4. Applicants amend claim 9 to describe more broadly the step of removing the anti-tarnish coating.
5. Applicants respectfully submit that the rejection against claim 1 under 112, first paragraph or the second paragraph is improper because MPEP §2172.01 requires inclusion of matter *essential* to the invention and the interrelation of the *essential* elements:

   > A claim which omits matter disclosed to be essential to the invention as described in the specification or in other statements of record may be rejected under 35 U.S.C. 112, first paragraph, as not enabling. In re Mayhew, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). See also MPEP § 2164.08(c). Such essential matter may include missing elements, steps or necessary structural cooperative relationships of elements described by the applicant(s) as necessary to practice the invention.
   >
   > In addition, a claim which fails to interrelate essential elements of the invention as defined by applicant(s) in the specification may be rejected under 35 U.S.C. 112, second paragraph, for failure to point out and distinctly claim the invention.

   Since none of the elements noted in §10(c) of the Office action is described in the specification as being "essential" to the invention, MPEP §2172.01 is not applicable.
6. The offending terms - "component" in claim 1, "prior to coating the bondpad" in claim 3, and coating "the bondpads" are removed.
7. Claim 1, as amended, overcome the 103 rejection over the Haji reference in view of the Arldt reference:

a. The references do not disclose all the elements of limitation in claim 1.

First, as amended, claim 1 limits the method to providing a substrate with copper bondpads that are substantially free of plated gold and substantially free of solder material on their surfaces. Both the Haji reference and the Arldt reference lack this limitation.

The Haji reference discloses a method of manufacturing an electronic component. In the abstract section, it notes:

> Nickel films 22, 25 are formed on copper pads 21, 24 on a substrate 11, and gold layers 23, 26 are further formed on the nickel films 22, 25. To suppress formation of compound of gold and tin which spoils reliability of soldering, formation of gold layers 23, 26 on the nickel films 22, 25 is effected by very thin substitutional plating method. As a result, a solder bump 17 is formed favorably. Besides, an (sic) nickel oxide film 32 formed on the surface of the gold layer 23 is removed by plasma etching. As a result, bonding of wire 15 is also excellent.[1]

In one embodiment, Haji coats the copper pad with a layer of gold that is 0.03 to 0.05 microns thick[2]; in the other embodiment, the gold layer is 0.1 to 1.0 micron thick.[3]

The Arldt reference discloses a flux composition for soldering electronic components to printed circuit boards. The contact pads 30 and 70 in Arldt are both coated with solder:

> ...contact pads 30 on the circuitry-bearing surface 20 of the chip 10 are provided with solder regions, e.g., solder balls, 40. These solder regions 40 have compositions which include, for example, 90 atomic percent lead (Pb) and 10 atomic percent tin (Sn).[4]
>
> ...prior to soldering the chip 10 to the PCB 50, contact pads 70 on the circuitry-bearing surface 60 of the PCB 50 are provided with relatively small solder regions, e.g., relatively small solder balls, 80. These relatively small solder regions 80 are readily transported to, and deposited on, the contact pads 70 via a decal 90. By contrast with the solder regions 40 used with the chip 10,

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[1] US 5909633, Abstract.
[2] See, Ibid, col. 3, ll. 34-37.
[3] See, Ibid, col. 5, ll. 3-6.
[4] US 5,531, 838, col. 4, ll. 59-63.

> the solder regions 80 have compositions which include, for example, 37 atomic percent Pb and 63 atomic percent Sn.[5]

Second, claim 1 limits the method to subject the chip and the substrate to a high-temperature encapsulation step and as a result, the surface of the copper bondpads is oxidized. Both the Haji reference and the Arldt reference fail to disclose this limitation.

In Arldt, there is no high-temperature encapsulation step at all. In Haji, the copper pads are covered with a nickel layer and a gold layer. Therefore, the copper underneath the layers is not a part of the reaction during the high-temperature step:

> ... Reference numerals 32 and 33 are nickel compounds such as nickel hydroxide and nickel oxide formed on the surface of the gold layers 23, 26 of the electrodes 14, 16. These nickel compounds 32, 33 are formed as a result of reaction of nickel mixing into the gold layers 23, 26 in the plating process, with oxygen or moisture on the surface of the gold layers 23, 26 in the process of heat treatment.[6]

Third, neither reference discloses coating the etched bondpad with an anti-tarnish solution.

Because the Haji reference and the Arldt reference do not disclose all the limitations in claim 1, they do not render claim 1 obvious.

b. The references fail to teach the problem that claim 1 is designed to solve.

It is well established that it is not proper to conclude that an invention would have been obvious where there is no evidence of record that a problem is expected.[7] The source of the problem disclosed in this application is the oxidation of the copper bondpads uncovered by a gold layer during a high-temperature encapsulation step. The copper pads in Haji are well covered with a nickel layer and a gold layer and are not exposed to the oxidizing environment, and consequently the copper is not oxidized. Since there is no copper oxide formation on the copper pads, Haji can not be said to have taught the problem solved by the invention in claim 1. In Arldt, the contact pads are not subject to oxidation at a high temperature encapsulation step and so it can not expect the problem caused by such a process step as described in this application.

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[5] Ibid, col. 4, l. 66 – col. 5, l. 7.
[6] US 5,909,633, col. 3, ll. 47-54.
[7] See, e.g., In re Peehs, 612 F.2d 1287, 204 USPQ 835 (CCPA 1980).

c. The references do not teach combining all the limitations in claim 1.

It is well established that obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination.[8] There can not be teaching, suggestion or incentive to combine all the limitations in claim 1 because the references do not teach the source of the problem and therefore can not expect to suggest a solution to it. Furthermore, since the references do not disclose all the elements in claim 1, even if there is incentive to combine, the references can not teach combination of elements not disclosed in the references.

In summary, claim 1 can not be render obvious by the Haji reference and the Arldt reference because the references do not teach all the elements in claim 1, the references do not teach the source of the problem, and the reference do not support combining all the elements in claim 1. Therefore, a case of prima facie obviousness can not be established and claim1 stands patentable over the cited references.

8. Claims 3 – 7 and 9 - 14 depend directly or indirectly on claim 1. It is well established that if an independent claim is not obvious, the claims that depend on it must not be obvious. Therefore, claims 3 – 7 and 9 – 14 stand patentable at least by virtue of their dependency.

9. Newly inserted claim 21 includes the following elements:

    a. a substrate with copper bondpads of which the outer surface is substantially free of plated gold, nickel, and solder material;

    b. encapsulating a chip on the substrate at high temperature such that the surface of the copper bondpads are oxidized;

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[8] In re Geiger, 815, F.2d 686, 2, USPQ 1276.

c. submerging the assembly in a etching solution to remove the oxide from the bondpads uncovered by gold or solder material; and

d. coating the bondpads after etching with a anti-tarnish solution.

This claim is fully supported in the original specification and distinguishes over the cited reference for the same reason presented in Section 7 of this paper relating to claim 1. Therefore claim 21 stands patentable.

10. Claim 22 – 25 depend directly or indirectly on claim 21 and stand patentable for the same reason as presented in Section 8 of this paper relating to claims 3 – 7 and 9 – 14.

In conclusion, applicants respectfully submit that, as amended, this application is in allowable form and the pending claims distinguish over the cited reference and are therefore patentable over the references. Applicants respectfully request that this application be further examined and the pending claims timely pass to allowance.

Respectfully submitted,

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